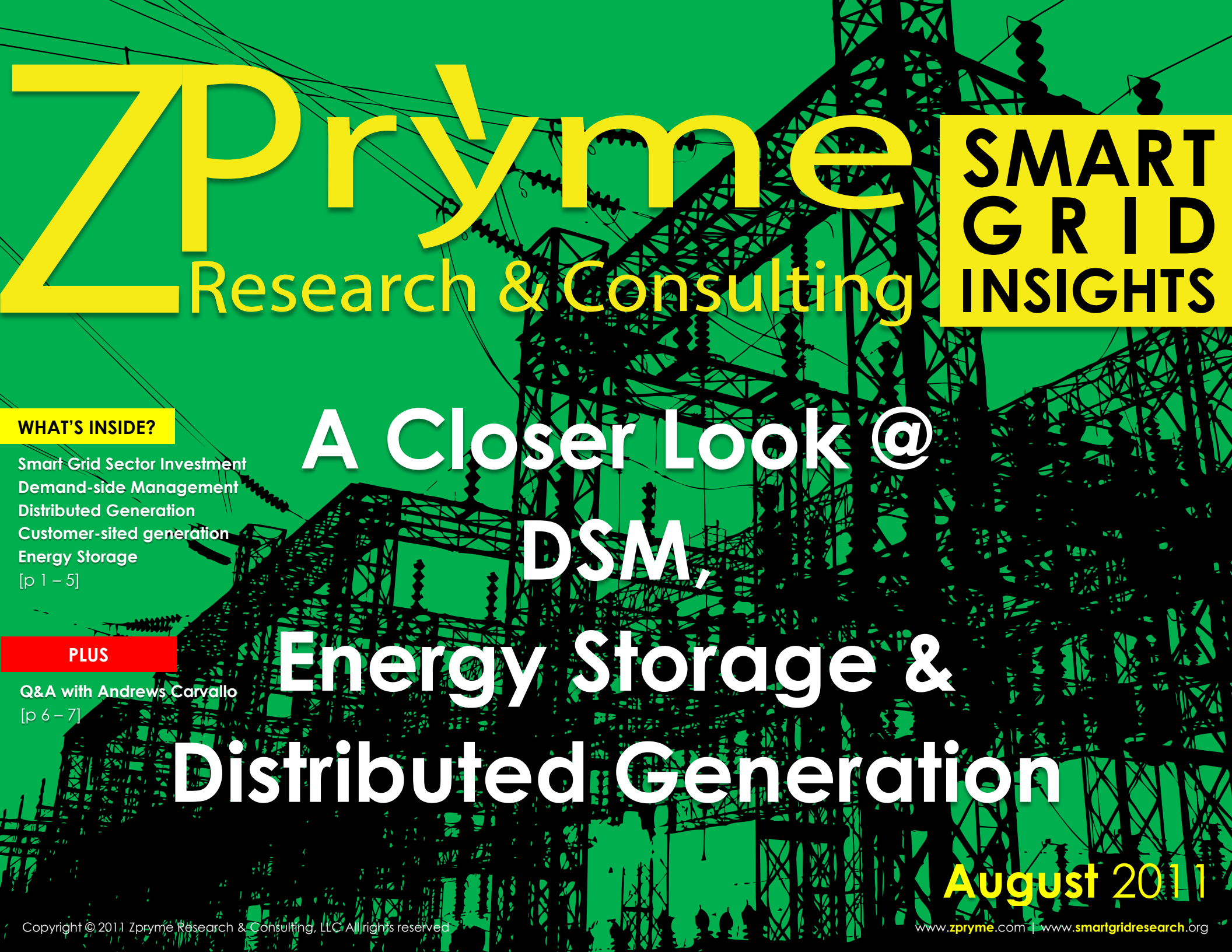

Zpryme Research & Consulting

SMART GRID INSIGHTS

A Closer Look @ DSM, Energy Storage & Distributed Generation

WHAT'S INSIDE?

PLUS

August 2011

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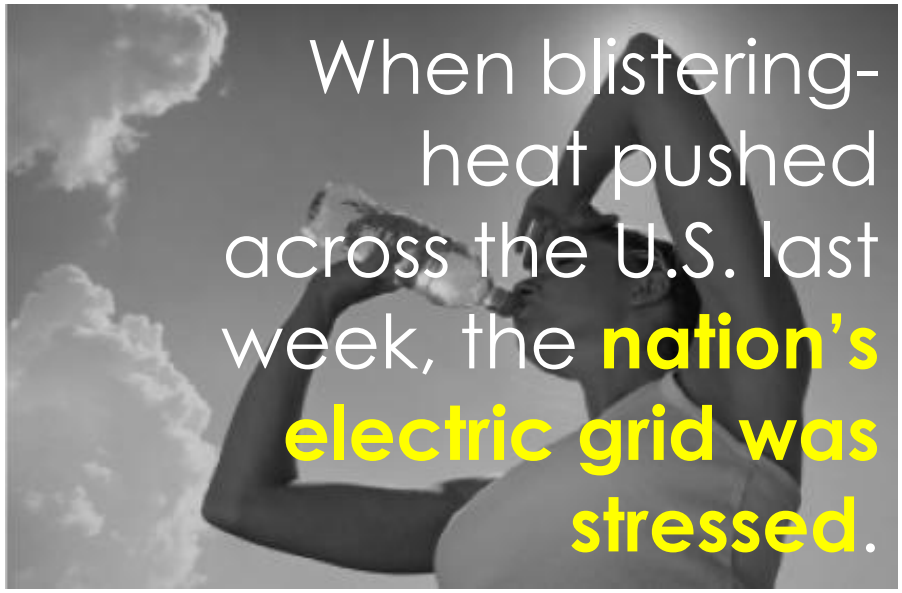
Smart Grid Insights:

A Closer Look at DSM, Energy Storage & Distributed Generation

This past July ('11), the United States power grid experienced record-breaking heat with a major contribution to curtail the rise from the smart grid. The upswing in heat spread across the southeast, prompting a surge in peak-time energy consumption…

When blistering-heat pushed across the U.S. last week (July '11), the nation's electric grid was stressed. Resonating from the southeast and spreading across the nation, much of the U.S. grid is more than five decades old -- leading to generous energy excess. Consequently, the 'Smart Grid' has roared into the forefront of the energy industry backed by major investments from private firms and the US government. Boiled down to its simplest form, a smart grid envisions a way to "maximize the output of the [electrical] system while reducing energy consumption… to utilize electricity as efficiently and economically as possible."



Beginning with the Energy Independence and Security Act of 2007, the Federal Government implemented guidelines and policy to encourage the development of smart grid technology. The American Reinvestment and Recovery

Act (ARRA) directed over $4.5 billion for "electricity delivery and energy reliability modernization efforts," of which smart grid development plays a central role. A report from the Executive Office establishes several objectives for upgrading the electric grid, namely to enhance consumer choice, create jobs and exports, and develop clean and secure renewable generation.

As smart grids striving for such outcomes are planned and developed across the country, several sectors stand out for their growth potential. Energy storage, residential or customer side PV, Demand Side Management (DSM), and distributed generation have all seen increased proliferation thanks to policies designed to advance the investments of the Recovery Act. Utilities and businesses have formed partnerships in pilot programs and test markets across the country, often utilizing ARRA matching grants to total over $8 billion.

State and local governments have also implemented their own policies to drive the innovative technologies behind a 21st century grid. Roughly 25 states have adopted policies encouraging smart grid development. Still other states have instituted Renewable Portfolio Standards while public utility commissions have attempted to align market and utility incentives to reward energy efficiency rather than the volume of retail electricity sales.

Smart Grid: Demand-side Management.

Demand-side management (DSM) refers to the timing and level of electricity demand. It encompasses energy and load-shape modifying activities undertaken in response to utility-administered programs. Demand-Side Management covers the complete range of load-shape objectives, including strategic conservation and load management, as well as strategic load growth.[1] As an example, Tallahassee, Florida utilized $8.8 million of ARRA funds to implement a smart-grid based DSM program that allows consumers to remotely cycle off their air conditioners during times with peak rates. Increasingly, other utilities are examining ways to avoid the cost of new peak generation units by shaving load. In 2000 the peak load reduction for the country amounted to 22,901 MW.[2] By 2010 that had grown 42 percent, to 32,845 MW of peaking power shifted.[3]

As the software and energy management systems continue to evolve, DSM projects have expanded to residential, commercial and industrial customers. Home Area Networks, Electric Vehicles and decoupled utility structures will continue to drive innovation in DSM technologies and strategies.

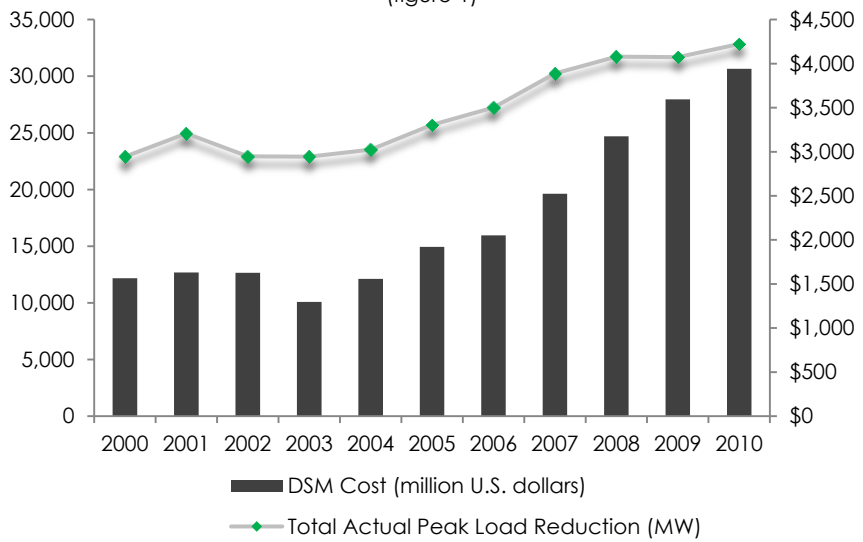
Costs of demand-side programs incurred by utilities have increased dramatically. The combined annual expenses of labor, administrative, equipment, incentives, marketing, monitoring and evaluation totaled across the country amount to $3.94 billion on DSM in 2010, representing a 10 percent compound annual growth in the sector since 2000.[4]

[1] Definition provided by Energy Information Administration (EIA) glossary of terms (www.eia.gov).
[2] U.S. EIA, Electric Power Annual 2000 - 2009 (Form EIA-861). 2010 is forecasted by Zpryme.
[3] Ibid.
[4] Ibid.

Smart Grid: Demand-side Management Outlook.

In the short-term, Zpryme expects U.S. DSM investments grow at an annual average of rate between 9% - 12% over the next five years. As smart grid deployments increase, Zpryme predicts strong growth for time-of-use pricing programs offered by utilities. Conversely, consumer education will remain the "key" to maximizing consumer participation in such programs.

U.S. Demand Side Management Costs and Peak-Load Reductions 2000 - 2010*
(figure 1)

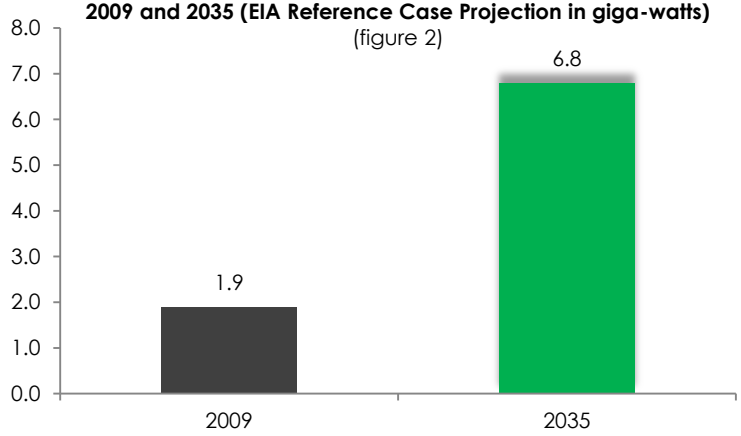


Source: U.S. EIA, Electric Power Annual 2000 - 2009 (Form EIA-861). 2010 is forecasted by Zpryme.

Smart Grid: Distributed Generation.

Localized policies that further develop the demand side of the smart grid often incorporate distributed generation (DG) incentives. Big box retail outlets and other commercial sector customers have begun to explore the economics of supporting their own needs through on-site generation. Smart grid technologies will work in concert with policies that facilitate DG interconnection. Net metering, virtual net metering and lower maximums for interconnection are all enabling strip malls and franchises to aggregate their own generation and potentially sell that back to the servicing utility. The EIA projects strong gains for the commercial DG sector, as they project capacity to increase from 1.9 giga-watts in 2009 to 6.8 giga-watts in 2035.[5] They project an additional 2.37-2.6 giga-watts of microturbine generation to come online in that timeframe, while solar PV could see between 1.1 and 2.95 GW during the next 25 years.[6] Combined Heat and Power systems make up another projected 1 GW of commercial DG.[7] Smart grid technologies that manage and distribute this two-way flow between several different entities are pushing the high end of these expectations as is the extension of the federal investment tax credit of 10 percent through 2016.

U.S. Commercial Sector Distributed Generation Capacity 2009 and 2035 (EIA Reference Case Projection in giga-watts)
(figure 2)



Source: The EIA 2011 Annual Energy Outlook (reference case projection)

[5] The EIA 2011 Annual Energy Outlook, reference case projection.
[6] The EIA 2011 Annual Energy Outlook, reference and extended polices projection.
[7] The EIA 2011 Annual Energy Outlook, reference and extended polices projection.

Smart Grid: Distributed Generation Outlook.

In the short-term, Zpryme expects U.S. DG capacity in the commercial and industrial sector to grow at an annual average of rate between 7% - 10% over the next five years. During this time period, DG capacity in the U.S. will be driven heavily by the commercial and industrial sector's need to decrease their utility costs.

Smart Grid: Customer-sited generation.

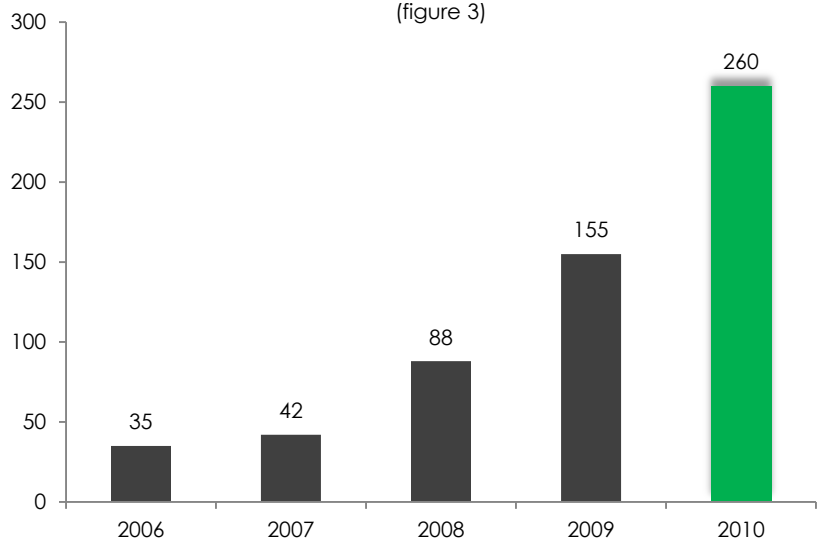
The focus on smart grid development and customer choice has brought about a new era of solar power development on the customer side of the meter. Feed–in tariffs, net metering or cash rebates have all been utilized to encourage smaller home-mounted renewable systems. Smart Grid pilot projects envision a home that can manage its own micro-grid that, paired with the right incentive policies, ultimately shifts electricity around depending on its economic value at a given time and price. Extended Federal tax credits have given PV purchasers confidence in recent years and the U.S. has seen its residential solar capacity jump from 35 MW nationwide, to 197 MW in California alone by 2010.[8] The country as a whole boasted 260 MW of residential capacity in 2010. The Golden State has accounted for more than half the national share of residential solar capacity since 2007.[9]

[8] IREC Solar Trends Report, June 2011 and California Solar Statistics (CA data includes installations from PG&E, SCE and CCSE).
[9] Ibid.

Smart Grid: Customer-sited Generation Outlook.

In the short-term, Zpryme expects U.S. customer-sited generation capacity to grow at an explosive annual average of rate between 40% - 50% over the next five years. Solar will continue to lead the way as more states will continue to offer incentives for consumers to purchase solar panels for their homes. The costs for residential solar panels will continue to fall significantly over the next five years.

U.S. Total Installed Residential Solar Capacity
2006 - 2010 (MW)
(figure 3)



Source: IREC Solar Trends Report, June 2011

Smart Grid: Energy storage.

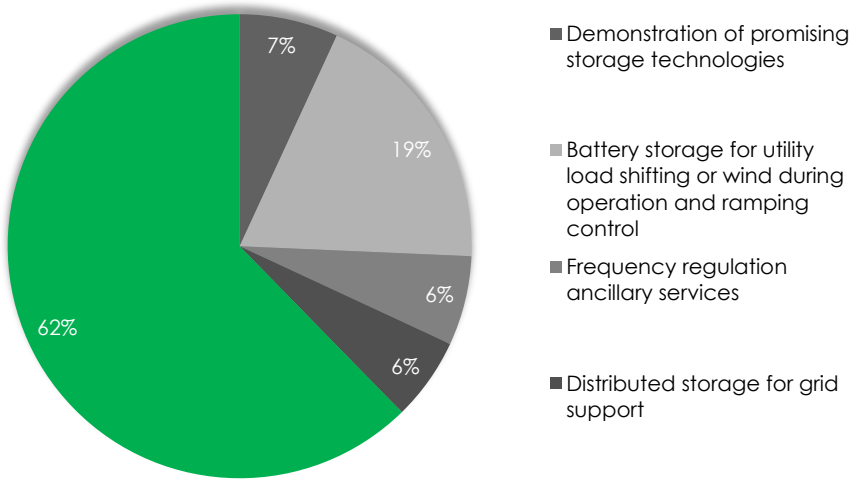
Storage is, in many ways the glue which can hold together the many disparate objectives industry and government have for smart grid benefits. The ability to rapidly charge and release energy, to do so many times without significantly deteriorating the quality of the energy, and an

increased storage capacity are all ultimately necessary components to a robust smart grid. Energy storage can gain transmission efficiencies through voltage regulation; can store intermittent and distributed renewable energy to release in times of inactivity and shift peak loads. The forthcoming electric hybrid vehicle fleets are widely seen as an entry into a world of distributed energy storage and aggregated storage capacity significant enough to provide meaningful load shifting. Currently, the vast majority of energy storage – 22,000 MW of 23,251 nationally, is accomplished through pump hydro systems.[10] Compressed air storage accounts for 115 MW with Lithium Ion batteries making up a mere 54 MW, slightly less than double the storage provided by flywheels.[11] However, the prospects for energy storage technologies are bright as $185 million in ARRA grants has brought more than $770 million in total investment in storage systems adding 537 MW to the grid since 2009.[12]

Smart Grid: Energy Storage Outlook.

In the short-term, Zpryme expects U.S. energy storage technology investments to grow at an annual average of rate between 20% - 30% over the next five years. Public and private sector investments, mainstream adoption of EVs, and the pace of smart grid deployment will all play a key role in the devilment of the U.S. energy storage market.

Distribution of Total ARRA Energy Storage Project Funding by Technology Type (Total = $771.8 million)
(figure 4)



Source: Source: Sandia National Labs, summary of ARRA Energy Storage Projects

Smart Grid: What's Next?

While smart grid issues are still being ironed out, utilities will have to focus on exploring and engaging new technology capabilities to capture the future benefits fully. By utilities putting a greater emphasis on two-way communication for data retrieval, aggregation and analysis coupled with a clear DSM, energy storage & distributed generation plan, the potential to monitor and then respond to consumer energy consumption behavior can (will) benefit everyone — with an emphasis on *everyone*.

[10] *Energy Storage Activities in the United States Electricity Grid*, Electricity Advisory Committee (May 2011). Data provided by the Electricity Storage Association.
[11] Ibid.
[12] Sandia National Labs, summary of ARRA Energy Storage projects: (http://www.sandia.gov/ess/docs/ARRA_StorDemos_10-13-10.pdf)

Q&A

Andres Carvallo

Andres Carvallo is the Chief Strategy Officer at Proximetry and the author of the new book - "The Advanced Smart Grid". Mr. Carvallo became an early smart grid proponent, defining and promoting the term "smart grid," was the chief architect of the first fully deployed smart grid in the United States, and was also the chief architect of Austin's innovative Pecan Street Project. He has received over 22 awards for his industry contributions including 2006 CIO 100 by CIO Magazine, 2009 CIO of the Year by Energy Central and the Networked Grid Top 100 by GreenTech Media in 2010. Carvallo is currently a board member of the Utility Telecom Council's Smart Networks Council and an energy and technology advisor to several leading universities around the country.

1. [ZP] What differentiates your book, "The Advanced Smart Grid", from other books on the market about the smart grid?

[AC] All other books and white papers are theoretical volumes with no real world deployment to back them.

The Advanced Smart Grid uses the design and construction of the first citywide smart grid in the US as a case study, sharing the many successes and lessons learned. You gain working knowledge of successful tools and best practices that are needed to overcome diverse technological and organizational challenges as you strive to build a next-generation advanced smart grid (smart grid 2.0). Additionally, this unique book offers a glimpse at the future with interconnected advanced smart grids and a redesigned energy ecosystem (smart grid 3.0).

2. [ZP] Overall, what are one or two of the key lessons, messages or themes that can be taken from "The Advanced Smart Grid"?

[AC] The Advanced Smart Grid places emphasis on practical "how-to" guidance with a first-hand, insider's perspective on the advent and evolution of smart grids in the 21st century (smart grid 1.0). You gain a thorough understanding of the building blocks that comprise basic smart grids, including power plant, transmission, substation, distribution, and meter automation. Moreover, this forward-looking volume explores the next step of this technology's evolution. It provides a detailed explanation of how an advanced smart grid incorporates demand response with smart appliances and management mechanisms for distributed generation, energy storage, and electric vehicles.

3. [ZP] How is Proximetry helping utilities build intelligent electric systems (smart grids)?

[AC] Proximetry delivers network and performance management solutions for today's increasingly complex wireless ecosystems, bringing greater predictability to mission-critical traffic traversing today's "multi-multi" wireless network environments. The company's carrier-class software solution, AirSync™, helps energy, transportation, and next generation networks and their network operators provision and manage performance impediments associated with dynamic operating environments and ensure optimal network performance. Proximetry licenses its AirSync software to service providers, solutions providers and networking hardware manufacturers around the globe. Founded in January 2005, Proximetry is a privately-

held, venture-backed company headquartered in San Diego, California and Poland.

AirSync is the leading wireless network and performance management solution to enable private and commercial carrier-grade dynamic wireless network control through a single integrated system. It is designed to manage performance across multiple radio technologies, protocols, and network topologies (including 4G LTE, WiMAX, 3G, Wi-Fi, RF-mesh, and others). AirSync provides the tools for energy, transportation, and next generation network operators to provision and manage complex, mission-critical wireless networks. With its integrated approach to bandwidth optimization, resource selection and modification, and centralized scheduling, networks will achieve greater efficiencies in throughput ensuring the "best network, best frequency, and best utilization time" with predictable performance and compliance.

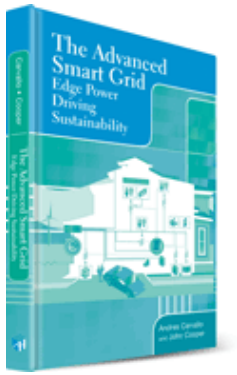
4. [ZP] How will the smart grid increase the adoption of energy storage technologies?

[AC] As new distributed energy technologies evolve and proliferate in their adoption (e.g. solar PV, electric vehicles, etc.), energy storage will become a key indispensible component of the new two-way power flow distribution smart grid designs that will be needed to support residential and commercial customers. The Advanced Smart Grid is the missing platform to integrate historical energy silos that will now work together to redefine.

5. [ZP] Do distributed energy from wind and solar sources also stand to benefit from the smart grid?

[AC] Read answer above. As long as the new generation is distributed the smart grid will play a more fundamental role. The grid is already smart as it relates to central generation. There are some new technologies, like PMUs, that will help enhance renewal central generation resources.

Andres Carvallo's new book: The Advanced Smart Grid



"In The Advanced Smart Grid, Andres Carvallo and John Cooper give us insight into how the evolution and integration of ICT and the electric system will power our 21st century economy."

– George W. Arnold, National Coordinator for Smart Grid Interoperability at NIST and U.S. Department of Commerce

Overview: The Advanced Smart Grid

Placing emphasis on practical "how-to" guidance, this cutting-edge resource provides you with a first-hand, insider's perspective on the advent and evolution of smart grids in the 21st century (smart grid 1.0). You gain a thorough understanding of the building blocks that comprise basic smart grids, including power plant, transmission substation, distribution, and meter automation. Moreover, this forward-looking volume explores the next step of this technology's evolution. It provides a detailed explanation of how an advanced smart grid incorporates demand response with smart appliances and management mechanisms for distributed generation, energy storage, and electric vehicles.

Purchase 'The Advanced Smart Grid' @ www.ciomaster.com

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